



**ACCELERATOR EXPERIMENT--Split Tune Compensation Studies**

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Purpose

To check the split system trim algorithm for eliminating the dependence of the external beam elevations on the switchyard beam split ratio.

Introduction

Whenever a change in the splitting ratio of the external beam is executed at a given splitting station, a pure vertical translation of the beam centre of mass occurs in both beam components at the wire septum. This normally requires vertical trimming downstream, and also results in major split ratio changes in downstream split stations.

A compensating algorithm has been designed to bring both split beam components to a fixed elevation and vertical orientation in their respective lines, independent of the split ratio setting.

Test Conditions

200 GeV slow spill with 2 Booster batches ( $\sim 3 \times 10^{11}$  ppp). Proton electrostatic septa and Meson electrostatic septa voltages were 50 kV and 60 kV respectively.

Test #1

Method

Vary the P/v ratio and, using the calculated compensating algorithm of MVT-92 and MVT-100, check for

- a) no vertical translation at MVT-100;
- b) no vertical orientation change at MVT-100.

### Results

Changing the P/v split ratio from 0-100% theoretically moves the beam vertically 6.2 mm at the Proton wire septum. Beam translation was observed on the MQ-100 SWIC, and beam vertical orientation changes were observed by observing the SWIC at MV-100.

The table below indicates the results of the compensation for P/v split ratio variation.

M/v Split Set at 50%/50%

MVT90 (amps)	MVT92 (amps)	MVT100 (amps)	Beam Elev. at MQ100 SWICW (mm)	Beam Elev. at MV100 SWICW (mm)	M/v Ratio Observed	Tune
11.0	18.9	30.9	26.1	27.4	50%/50%	Compensated
0.0	22.3	27.8	26.2	27.4	50%/50%	Compensated
11.0	22.3	27.8	29.4	28.5	No Trans. to M-Line	Uncompensated

### Test #2

#### Method

For a fixed P/v ratio, vary the M/v ratio and use the compensation algorithm on MVT-103 and MVT-201.

Check for

- a) no vertical translation at MVT-201;
- b) no vertical orientation change at MVT-201.

### Results

The M/v ratio was changed from 50%/50% to 80%/20% with MVT-101.

The table below indicates the results of the compensation as observed at the MQ-200 and MQ-205 SWIC's. The first SWIC in Meshall also showed no vertical motion during the M/v split ratio change.

P/v Split Set at 0%/100%

MVT101 (amps)	MVT103 (amps)	MVT201 (amps)	Beam Elev. at MQ200 SWIC (mm)	Beam Elev. at MQ205 SWIC (mm)	M/v Ratio Observed	Tune
10.0	10.9	35.8	26.0	23.1	50%/50%	Compensated
20.0	7.1	32.5	26.1	22.8	80%/20%	Compensated

Conclusions

The effects of split ratio changes in switchyard beam elevations can be successfully cancelled by an algorithm involving three dipole magnets per splitting station.

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